Unit 2: Construction Design

Delivery guidance

This mandatory unit will give learners the knowledge and skills they need to apply to the design and construction of low and medium-rise buildings.

Within the delivery of this unit, there are opportunities for a range of design activities to be carried out, along with practical investigations of existing building projects. In this unit, site visits and the involvement of local employers are highly recommended.

Approaching the unit

This unit can be delivered using a range of different methods such as presentations, task sheets, mini-research tasks, case studies and site visits. The focus should be to develop the skills of learners so that they can produce design concepts, identify design constraints at an early stage and plan cost-effective and viable solutions that satisfy clients' requirements.

Learners will be able to learn about sustainability aspects of the choices made at the design and construction stages. To produce suitable solutions, learners will be able to draw on their learning in other units of the programme relating to graphical communication, construction technology, project management and building science.

Delivering the learning aims

Learning aim A

Learning aim A provides the foundation for this unit. Learners are first introduced to the stages and tasks involved in the design process. This is followed by an investigation of the factors that influence the design process, such as client requirements, budget and regulatory constraints.

To begin analysis of the process, you could introduce learners to a suitable plan of work that is recognised by local public and private organisations. You could use a recent construction project in the local area and discuss with learners the possible reasons for its development. You could use a construction project that learners are familiar with, such as a new campus building or a housing development. A class discussion could then be used to inform learners' when they carry out their own independent study into client requirements for projects.

You could then discuss how client requirements often lead to the identification of a range of constraints, such as site and planning constraints. Again, the same project could be considered, with learners investigating the constraints that existed and how those constraints influenced the final design.

You could then introduce other constraints such as statutory, social and environmental constraints, as well as project budget, for different building projects. These topics can be delivered using a range of methods, including paired and group research tasks.

Learning aim B

In Learning aim B, you should support learners to develop a good understanding of how to interpret client requirements in order to produce an initial project brief. You could use a range of case studies as well as guest speakers. The focus will be on the development of a project brief.

This could then be complemented by paired or group activities where learners investigate the planning and statutory constraints associated with given projects or case studies. Finally, you could introduce learners to the various analytical skills that they will need to use when producing their own designs and initial project briefs, including spatial requirements, desired project outcomes, site information and budget requirements.

You should also develop the visual presentation skills that learners will be expected to use, such as 2D and 3D sketching, rendering and use of technical drawings. These skills could then be used by setting learners a number of design challenges to develop a range of initial ideas. The challenges could be linked with an industry partner, who may give learners suitable projects to address.

Learning aim C

Learning aim C deals with construction methods and techniques and will link closely with *Unit 1: Construction Technology*. Learners could work in groups to investigate the different forms of construction available. This learning aim should be an opportunity to work with an industry partner to look at case studies and identify the advantages and disadvantages of each method. Learners could be given a range of scenarios and asked to select an appropriate technique and justify their decision.

Learners will be introduced to site investigations and the information that can be gained from them. Case studies presenting the different forms of substructure could be introduced and discussed in groups to develop learners' understanding of when and why certain substructures are used.

Following this, the group can be challenged to research the function and types of primary and secondary elements of superstructures. This research could be supplemented by looking at existing projects so that learners can identify and justify the selection of different types of elements. These could be the same case studies as investigated in learning aim A. Working in small groups, learners could develop the initial design, consider suitable construction methods and justify the selection of the form of construction and the materials used for each element of the superstructure.

Finally, learners should be introduced to the range of sustainability methods and techniques that can be incorporated into a building project. They should research the modern techniques for improving the energy efficiency and reducing the carbon footprint of the building. Learners can research modern buildings that have been assessed under the British Research Establishment Environmental Assessment Method (BREEAM) or Leadership in Energy and Environmental Design (LEED) systems and identify the sustainable techniques that have been adopted.

You could work with a local design or construction organisation to give learners the opportunity to present and discuss their final design and construction solutions.

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Assessment model

Learning aim	Key content areas	Recommended assessment approach
A Understand the construction design and build concepts and processes	**A1** Stages and tasks involved in the design process **A2** Factors that influence the design process	This unit will be assessed by an externally set and internally assessed Pearson Set assignment. You will be provided with a scenario and requirement to design an appropriate solution taking into account all factors that impact of the design.
B Project information and building design production	**B1** Project information **B2** Initial project brief **B3** Design production **B4** Computer-aided design	
C Construction methods and techniques	**C1** Forms of low- and medium-rise structures **C2** Sub-structure construction	

Assessment guidance

As the extended external assessment relates to a pre-release case study, it is important that learners are fully prepared and have the skills they need to be able to interpret clients' requirements, identify design constraints, produce an initial project brief, produce a design proposal and plan the most suitable construction method.

This is most likely to be achieved with a range of practical design tasks where learners could address aspects of the content before carrying out a practice task, probably based on the Sample Assessment Materials. It is important for learners to have a good understanding of the materials and processes involved in the design and construction of buildings. You should ensure that they also are proficient in presenting design ideas and have the skills to produce annotated 2D and 3D sketches manually, as well as using CAD software to produce a virtual model of the design solution.

Getting started

Unit 2: Construction Design

Introduction

You could approach this unit in a number of ways. It is likely that once the underpinning knowledge and understanding within learning aims A, B and C are covered, a more holistic approach could be employed. This would give learners a similar experience to what they will encounter in their external assessment.

Where possible, make the most of opportunities to develop links with local construction and design companies. They may be able to provide suitable design challenges or scenarios that could be used by learners to develop their design skills.

Learning aim A – Understand the construction design and build concepts and processes

Learning aim A could be introduced by a discussion of the possible stages involved in a typical construction project. Follow the recognised plans used by local public and private sector organisations. The focus is on identifying the work involved with the design of low- and medium-rise domestic, commercial and industrial buildings.

Learning aim A1

- There are many factors that will influence the design process of a proposed new building project. Learners would benefit from an initial tutor presentation on the regulations, followed by small group or paired activities to develop research skills.

Learning aim A2

- As a group, discuss the client requirements of projects, such as a new shopping centre, hotel, office block or housing development.
- In pairs, ask learners to research different projects and create a spider diagram of all the different requirements. Allow the learners to compare their ideas to ensure they have covered all the possible requirements. This will also allow learners to develop their interpersonal skills.
- There may be a number of possible alternative sites for a planned construction project. As a group, investigate site constraints that may impact on the design.
- Research the range of local planning and statutory constraints that impact on the design of the building. Ask learners, in small groups, to investigate a number of such constraints and present their findings to the whole group. This will develop transferable skills they may need in future employment.
- There are a number of other constraints that will impact on the design of the building, such as environmental, social and economic. A group discussion on the range of constraints within each topic should help learners to understand possible factors that may influence the design process.
- You should also make learners aware of legal and statutory constraints that apply to construction projects locally, including regulations that relate to planning, land use and accessibility.

Learning aim B – Project information and building design production

Learning aim B1

- Within learning aim B, you will support learners to examine client's requirements for a project, taking into consideration external factors such as planning, statutory, environmental, social and economic constraints and produce an initial project brief.
- This section offers you the opportunity to develop links with an industry partner who could identify possible projects that your learners could investigate.

Learning aim B2

- From their investigation of the client's requirements and consideration of the constraints, learners could produce initial project briefs. To start with, learners can work in groups. However, they should start working independently as early as possible because this is required for their external assessments.
- Introduce the learning aim by giving learners a relatively simple explanation of the information that should be included in an initial project brief, such as spatial requirements, desired project outcomes, site information and budget requirements. Learners could then work through this, in either small groups or pairs, to come up with specific design factors needed for the client's project identified earlier.
- Following on from this, learners should consider the planning and statutory constraints that relate to the design brief. Discuss as a group, and then ask learners to work in pairs to investigate the relevant planning and statutory constraints. Learners could then modify their own initial project brief based on their investigation.
- Learners can then explore environmental constraints specific to their project. In small groups, learners can study the social impact a project may have on an area.
- A determining factor for any project will be the financial constraints. Learners can research the life cycle costing, project budget and financial viability of the project.

Learning aims B3 and B4

- It is vital that the learners can not only communicate their initial project briefs in writing, but they also need to produce a range of two- and three-dimensional sketches, as well as 2D and 3D CAD drawings, so that the client can interpret their ideas. Learners need to be able to apply the 2D and 3D techniques listed in the unit content to produce sketches of internal and external views, plans and elevations.
- Tutor demonstrations to show technical draftsmanship skills and software functionality will be needed alongside a number of progressive activities to stretch the learners' ability in visual representation. Tutors should focus these activities on the use of CAD methodologies, production of virtual models, their manipulation and rendering of images. The activities should support learners so that they can extract the required drawings and obtain the output.
- A tutor demonstration of the use of basic CAD methodologies should include setting up drawings for the production of external views and site areas. Standard components should be included, along with fixtures and fittings. Learners could be given the opportunity to practice skills by reproducing existing drawings using CAD.
- Link with *Unit 7: Graphical Detailing* where appropriate to produce hand sketches and CAD to produce 2D plans, sections and elevations and 3D models.

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- To bring together learning for this section, you could offer learners the opportunity to complete a number of revision activities where they could consider the design factors and constraints and develop an initial project brief. Learners will need to produce a brief that fulfils the requirements of the project.

Learning Aim C – Construction methods and techniques

The focus of learning aim C is for learners to examine various construction forms and develop an understanding of techniques to construct sub-structures and superstructures, considering sustainability aspects and project requirements.

Learners should investigate modern techniques and practices, in particular, offsite construction. They should look at house builders that use modular units and cross-laminated timber technology to improve efficiency and productivity.

This learning aim also allows the opportunity to develop links with an industry partner who could identify possible projects that your learners could visit and investigate. You could use the same projects and case studies as in learning aims A and B.

Learning aim C1

- You could start by introducing various construction forms and then introduce learners to the functional requirements of primary and secondary elements. This could be expanded to cover the range of construction methods and techniques available through group discussion.
- In pairs, learners could investigate and produce sketches for a number of different construction methods. These investigations and sketches could then be presented to the rest of the class for discussion on the possible uses, advantages and disadvantages of each method.

Learning aim C2

- In this section there is a direct link with *Unit 1: Construction Technology.* Links with an industry partner could be used for activities such as site visits or guest speakers.
- Learners should understand the purpose of site investigations and the factors that influence foundation design. In small groups, different types of foundations and their suitability for various structures could be investigated. Learners could research the types of foundations and their details used for local and national building projects and justify why this foundation method was selected.

Learning aim C3

- In this section there is, again, a direct link with *Unit 1: Construction Technology*. Links with an industry partner could be used for activities such as site visits or guest speakers.
- Learners will need to understand the function of the primary and secondary elements used to construct the superstructure and external envelope of a range of different buildings.
- In small groups, different elements of superstructure could be investigated, such as external and internal walls, structural frames, ground floors, roof, stairs and landings, and doors and windows. This investigation should be expanded to cover the types of building constructed and the factors that may influence choices. Learners could research the form and type of construction used for a range of local and national building projects and justify why each method was selected.

- The advantages and disadvantages of modern construction techniques should be researched, such as offsite and modular construction. Learners should Investigate the growing importance of manufacturing in the design process.

Learning aim C4

- This section gives learners the opportunity to investigate sustainable methods and techniques that are a crucial part of any modern construction project. This is an opportunity to link with industrial partners and to research new technologies.
- Learners can review the work covered in *Unit 1: Construction Technology* when discussing how new materials/methods (e.g. modular building, cross-laminated timber) and designs can lead to lower costs and more sustainable projects.
- Learners should be introduced to the benefits of passive solar gain and passive stack ventilation. In small groups, learners should investigate the methods used to reduce the use of water within buildings and to reduce waste.
- To gain knowledge of a range of alternative energy sources available, learners should collaborate as a group to discuss the advantages and disadvantages of each method and research projects that have used each of the different methods.
- Learners should be made aware of other ways of improving the sustainability and energy efficiency of a building, such as insulation methods, sustainable urban drainage systems and sustainable landscape design.
- Finally, it will be useful to discuss with learners the concept of assessing the sustainability of a building by using case studies linked to assessments completed using BREEAM or LEED, and the purpose and benefits of this assessment method. This could be extended using case studies identified from the BREEAM website to identify the sustainable techniques used in each building.
- For the assessment, learners must be able to recommend and justify the possible size, form and type of construction to meet the client's needs for a proposed project. Give learners practice assessments at the end of this topic and provide feedback to help them develop their skills before the final assessment.

Details of links to other BTEC units and qualifications and to other relevant units/qualifications

This unit links to:

- Unit 1: Construction Technology
- Unit 7: Graphical Detailing
- Unit 11: Management of a Construction Project
- Unit 15: Measurement Techniques in Construction
- Unit 20: Quantity Surveying
- Unit 21: Building Service Science

Resources

In addition to the resources listed below, publishers are likely to produce Pearson-endorsed textbooks that support this unit of the BTEC Internationals in Construction. Check the Pearson website (http://qualifications.pearson.com/endorsed-resources) for more information as titles achieve endorsement.

Textbooks

Anderson, J., Shiers, D. and Steele, K., *The Green Guide to Specification* (4th Edition), IHS BRE Press, 2009, ISBN 9781848060715
Provides good information on sustainability and environmental issues.

Chudley, R. et al., *Construction Technology* (5th Edition), Pearson, 2011, ISBN 9780435046828
Provides information on construction techniques and sustainability.

Cooke, R., *Building in the 21st Century*, Wiley-Blackwell, 2007, ISBN 9781405156554
Provides information on modern building techniques with particular interest in sustainability and environmental issues.

Illingworth, J.R., *Construction Methods and Planning* (2nd Edition), CRC Press, 2017 ISBN 9781138408845
This book takes a practical approach and features examples and illustrations taken from real situations and sites.

Websites

BREEAM website – the British Research Establishment Environmental Assessment Method website

Leadership in Energy and Environmental Design website – this shows examples of a widely used method of green building rating system.

GOV.uk website for more on building regulations approval, guidance on party walls, Disability Discrimination Acts 1995 and 2005, Equality Act 2010, Landlord and Tenant Act 1985 and restrictive covenants.

GOV.uk website and search for the “National Planning Policy Framework 2012”

Health and Safety Executive website and search "The Construction (Design and Management) Regulations 2015

Pearson is not responsible for the content of any external internet sites. It is essential for tutors to preview each website before using it in class so as to ensure that the URL is still accurate, relevant and appropriate. We suggest that tutors bookmark useful websites and consider enabling students to access them through the school/college intranet.